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Differential birthweights and the clinical relevance of birthweight standards in a multiethnic society

J.P.R. Doornbos[a], H.J. Nordbeck[b], A.E. Van Enk[c], A.S. Muller[b] and P.E. Treffers[d]

[a]*Department of Obstetrics and Gynaecology, De Heel Hospital, Zaandam,* [b]*Department of Tropical Hygiene, Royal Tropical Institute, Amsterdam,* [c]*Department of Obstetrics and Gynaecology, Slotervaart Hospital, Amsterdam and* [d]*Department of Obstetrics and Gynaecology, Academic Medical Centre, University of Amsterdam (The Netherlands)*

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Abstract

Using a computer-stored database, birthweights and related variables of over 25 000 infants born in Amsterdam (The Netherlands) were analysed retrospectively. Only after allowing for maternal height, did the difference between mean birthweights of Dutch and Asian infants disappear, whereas Negroid and Mediterranean infants continued to show respectively lower and higher means than the others. These results confirm that the birthweight standards presently used are inappropriate for detection of deviant weight in non-Dutch groups.

Keywords: Birthweight; Ethnic; Birthweight standards.

Introduction

Birthweights and their relationships with biological and social characteristics of the mother are the subject of continuing research aimed at the prevention of death and damage in early childhood. Variations in birthweight between different ethnic groups worldwide are well documented and Meredith [1] has reviewed the world literature. Hytten and Leitch [2] highlight many of the differences in birthweight between ethnic groups within the same country. In England [3,4], black and Asian infants have considerably lower mean birthweights compared to white infants. In France [5], North African immigrants show significantly higher birthweights in comparison with native women. The variance in mean birthweights between populations is strongly reflected in the incidence of low birthweight (LBW < 2500 g). Correlation coefficients of 0.85 are quoted in the literature [6]. Therefore, the clinical relevance of the 2500 cut-off point is being questioned. Though LBW may be a powerful determinant of mortality risk in fetal, neonatal and postneonatal life [7], the incidence of LBW is only a crude measure, which subsumes a variety of physiological and pathological states. For this reason Rooth [8] proposed reference weights, which are specific for each individual country (i.e., the actual mean birthweight minus two standard deviations).

Likewise a debate exists with regard to birthweight centiles (taking into account gestational age, birth order and sex of the infant) for the purpose of detecting growth retarded infants. Tanner and Thomson [9] presented birthweight centiles allowing for maternal height and weight. Brooks et al. [10] provided separate birthweight standards for British born full term neonates in whites, blacks and Asians, respectively.

Carr Hill and Pritchard [11] pointed out the

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need to update the current Aberdeen birthweight standards and extensively discussed the problems involved in developing universally applicable standards. In The Netherlands the parity and sex specific birthweight percentiles derived by Kloosterman [12] from a series of 80 000 deliveries in Amsterdam (between 1931 and 1967) are most frequently used for reference purposes. It should be mentioned here that 99% of all infants included in the study of Kloosterman were of Dutch (Caucasian) origin. At present, however, immigrant births comprise over one-third of all deliveries in Amsterdam [13]. The aim of this study is to describe birthweight patterns of these (first generation) immigrants compared to the Dutch population. This allows us to discuss the relevance of the Amsterdam growth curves as well as the clinical significance of the LBW criterion.

Material and methods

Using a computer-stored database [14], obstetric variables of more than 40 000 births taking place in the five principal hospitals in Amsterdam over the years 1972—1982 could be analysed. First we excluded all (about 10 000) births occurring in the two academic hospitals (with large perinatal intensive care units), which have a strong regional function thus receiving many high risk gravidas from outside Amsterdam. Including these, nearly all Dutch pregnancies in our study would make the Dutch infants incompatible with those of the original Amsterdam growth curves and introduce a severe bias as Dutch infants would be highly overrepresented in the very low birthweight and early preterm categories.

According to their ethnic origin gravidas were divided into the following groups:

- Dutch (Caucasian) originating from Western Europe
- Negroids (originating from West Africa), mainly immigrants from Surinam and the Dutch Antilles
- Asians (originating from the Indian subcontinent, China or Indonesia), mainly immigrants from Surinam
- Mediterraneans, immigrants from Morocco or Turkey

Maternal height and weight were measured at antenatal clinics, weight being available for analysis at 20, 32 and 40 weeks of gestation. Birthweights were recorded to the nearest 10 g and were known for practically all of the cases. Gestational ages, in completed weeks, were calculated from the date of the last menstrual period (LMP). Included were certain dates (certain LMP and regular 28 days cycle) and almost certain dates (certain LMP and regular 21—35 days cycle for which the length of gestation was corrected), amounting to 85% of the total study population. Statistical analysis was performed with the chi-square test. For (direct) standardization the Mantel Haenzsel method was used.

Results

After excluding multiple births as well as births with uncertain or unknown dates, 25 604 deliveries were analysed; division over the four ethnic groups is presented in Table I.

Mean birthweights by ethnic origin and parity show considerable differences (Table II). Mediterranean and Dutch infants have the highest means; maximal differences between the groups reach approximately 200 g. Birthweight differences between sexes were comparable in all ethnic groups (100—150 g). We found an overall incidence rate of LBW (< 2500 g) of 7.6%. Negroid and Asian infants show the highest, whereas the Mediterranean infants show a relatively low rate of LBW (Table III).

Mean birthweights for each completed week of gestation were calculated. The resulting cross

Table I. Numbers of births by ethnic group.

Ethnic group	No. of births
Dutch	19 842
Negroid	1 585
Asian	1 976
Mediterranean	2 201
Total	25 604

Table II. Mean birthweights (g) and SDs (in parentheses) by ethnic group.

Ethnic group	Mean birthweight (g)	
	Primiparae	Multiparae
Dutch	3216 (584)	3352 (607)
Negroid	3039 (631)	3188 (673)
Asian	3027 (520)	3181 (608)
Mediterranean	3181 (608)	3391 (631)

Table III. Incidence rates (%) of LBW (<2500g) by ethnic group.

Ethnic group	Incidence rate of LBW (%)
Dutch	7.3
Negroid	10.6
Asian	10.0
Mediterranean	5.8

sectional growth curves are presented in Figs. 1 (for primiparae) and 2 (for multiparae). Boys and girls were combined in order to increase numbers (sex ratios as well as weight differences between sexes were very much the same for the four groups). In primiparae, Dutch infants show an increase in their mean weight up to the 42nd week. Mean weights of Negroid infants are equal to those of Dutch infants up to the 38th week, after which the increase in birthweight of Negroid infants is less pronounced. The same holds true for Asian infants be it on a lower level and from the 36th week onwards. Mediterranean infants show equal or higher mean birthweights as compared to Dutch infants up to the 41st week. In all immigrant groups, there appears to be a slight decline of the curves after the 41st week. For multiparae, results are approximately the same as for primiparae. A comparison of our data with the previously mentioned Amsterdam birthweight centiles (taking into account gestational age, birth order and sex of the infant) is presented in Table IV. Defining a SGA infant as being below the 5th percentile we found an overall rate of 5.1% with considerable differences between ethnic groups: Negroid and Asian infants show the highest, whereas the Mediterranean infants show a relatively low figure.

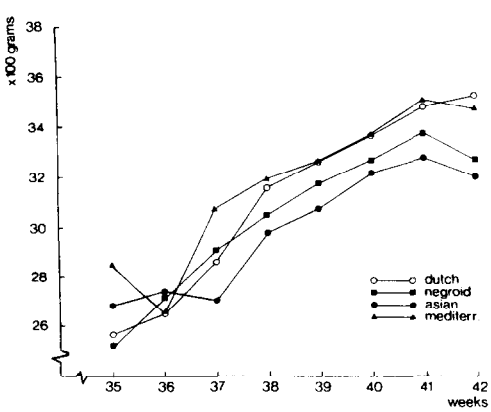

Fig. 1. Mean birthweight by gestational age for primiparae in four ethnic groups.

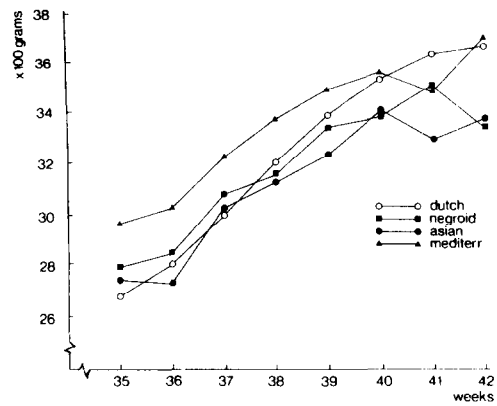

Fig. 2. Mean birthweight by gestational age for multiparae in four ethnic groups.

Table IV. Incidence rate (%) of SGA (< 5th percentile of the Amsterdam growth curve) by ethnic group.

Ethnic group	Incidence rate of SGA (%)
Dutch	4.9
Negroid	6.4
Asian	7.7
Mediterranean	3.4

Percentiles for infants of our present Dutch population come remarkably close to the reference weights, although the resulting cumulative frequency curve is slightly shifted to the left.

The variance in incidence rates of LBW and SGA between the four ethnic groups is not strongly influenced by standardization for age and parity of the mother (Table V).

Mean weights of Dutch, Negroid, Asian and Mediterranean primiparae at approximately 20 weeks of gestation were respectively 65, 62, 54.3 and 60.3 kg (standard deviations between 7.9 and 10.9). For multiparae these figures were higher being 65.9, 67.3, 56.8 and 64.8, respectively (standard deviations between 9.3 and 10). Average midpregnancy weights calculated for 5 cm height categories show a linear relationship between the two variables in all groups. In primiparae the resulting curves of Dutch, Negroid and Mediterranean women approximate each other while Asian women (having a more gracile physique) weigh less than the others with a variation per height category from 2 to 5 kg.

Because of the (among immigrants quite strong) relation between higher parity and obesity further analysis of maternal weight of multiparous women proved to be confusing. In primiparous women the average weight gain per week from 20 weeks onwards appeared to be comparable between the groups with a variation from 360 to 410 g.

Mean heights for Dutch, Negroid, Asian and Mediterranean gravidas were respectively 166.3, 162.4, 156.6 and 157.7 cm (standard deviations between 6.2 and 6.6). In most ethnic groups correlation coefficients between maternal height and birthweight were over 0.20 for primiparae as well as multiparae. Graphical representation of this relationship is given in Figs. 3 (for primiparae) and 4 (for multiparae); maternal height is subdivided into classes of 5 cm. Due to relatively low numbers of immigrant gravidas at the extremes of the height scale the resulting curves fluctuate at both ends. Infants born of Negroid women with heights from 155 to 169 cm (mean height plus/minus one standard deviation) show birthweights 50—100 g lower than the Dutch of the same height. Asian and Mediterranean women with heights between

Table V. Age and parity adjusted incidence rates (%) of LBW (<2500 g) and SGA (<5th percentile) by ethnic group.

Ethnic group	Incidence rate (%) of	
	LBW	SGA
Dutch	7.4	4.9
Negroid	10.5	6.3
Asian	9.7	7.5
Mediterranean	6.1	3.6

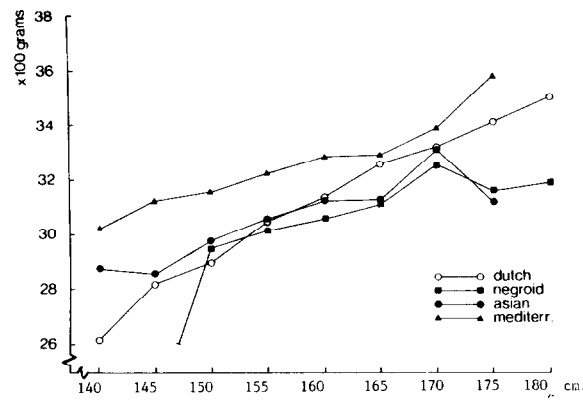

Fig. 3. Mean birthweight by maternal height for primiparae in four ethnic groups.

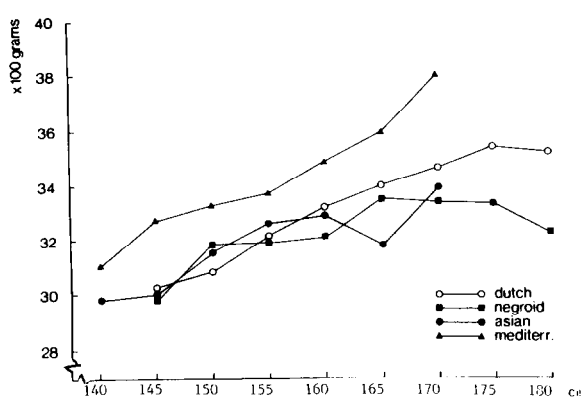

Fig. 4. Mean birthweight by maternal height for multiparae in four ethnic groups.

Table VI. PMR (%) by ethnic group.

Ethnic group	PMR (%)			
	Crude rate	Standardized for		
		Age/ parity	Gestational age	Birthweight
Dutch	2.2	4.0	2.5	2.4
Negroid	2.4	4.0	2.4	2.3
Asian	2.5	3.0	2.3	2.6
Mediterranean	2.4	2.7	2.3	2.3

150 and 164 cm (mean height plus/minus one standard deviation) respectively give birth to infants with up to 200 g higher birthweights in comparison with the same maternal height categories in Dutch infants.

In Table VI crude and adjusted perinatal mortality rates (PMRs) are presented (the perinatal mortality includes all stillbirths from 500 g upward and all first week deaths). The overall PMR in the Negroid population is significantly higher ($P < 0.05$) than in the other groups. Standardization for gestational age confirms that the excess mortality in this population group is mainly due to an increase in the (very) low birthweight and (early) preterm infants. PMRs in the other groups do not differ to an important extent.

Discussion

Only during the last 20 years has Amsterdam, as well as some other main Dutch municipalities, evolved into a community of multiethnic origin. It is well recognized that these first generation immigrants fare worse than the native Dutch population in the fields of education, housing and employment, while their utilization of health services is hampered by language problems and different cultural backgrounds [13]. It was to be expected that this disadvantaged position would have a negative influence on the outcome of pregnancy.

Up to now no literature on differential birthweights among ethnic groups in The Netherlands existed. The mean birthweights we established for three distinct immigrant populations closely resemble the ones established for the same (sub)populations in the respective countries of origin [15,16]. The considerable variations in mean birthweight in our data were not affected by taking into account birth order, gestational age, infant sex or maternal age. After adjusting for maternal height, however, the difference between birthweights of Dutch and Asian infants practically disappeared, whereas Negroid and Mediterranean infants continued to show moderately lower and considerably higher means than the Dutch and Asian infants respectively.

The first and obvious conclusion is that Asian infants are small not because their mothers are Asian (assuming a complex relationship between maternal physique and socioeconomical and cultural factors), but merely because their mothers are smaller than Dutch women. The physiological nature of the birthweights in this group is confirmed by the PMR which is the same as in the Dutch. To a certain extent this favorable result in the Asian population was unexpected. In England it was found that, even after allowing for maternal height, Asian babies were on average 190 g lighter than white infants [4], while the PMR among Asians was persistently higher compared with the native population [17,18].

The lower mean birthweight and considerably higher incidence of LBW in the Negroid population is only partly explained by a difference in maternal stature. After standardization, however, for gestational age or birthweight the significantly higher PMR in this group approximates the rates established for the other groups. In the United States perinatal mortality statistics consistently point out higher crude PMRs for the black population as compared to the white, whereas birthweight standardized rates are comparable. As in the United States, we found the excess mortality in the Negroid population to be obviously related to higher rates of (early) preterm and/or (very) LBW infants.

Mediterranean infants are born with higher

(height standardized) weights compared with Dutch infants. Allowing for maternal weight in the primiparous Mediterranean women did not explain the higher birthweights of their infants.

The fact that smoking is almost nonexistent in Turkish and Moroccan female immigrants will be responsible for some of the difference. However, as the relationship between (low) social class and (low) birthweight is well established [19], it is most surprising that the Mediterranean population living under relatively poor socioeconomic conditions show by far the highest birthweights.

The clinical significance of the Amsterdam reference weights as part of the overall assessment of the Dutch (Caucasian) newborn and as a lead to the management of following pregnancies is evident. For the purpose of identifying deviant birthweights in the non-Dutch groups these standards are inappropriate: Asian and Mediterranean infants are wrongly overrepresented in the weight areas designated as pathological. The complex relationship between maternal physique and birthweight makes the development of generally applicable birthweight standards hardly possible. From a clinical and practical point of view, however, the development of separate standards for each ethnic group is not realistic. This is even more true for the heterogeneous mixture of numerous ethnic groups at various stages of acculturation which will constitute the future population of Amsterdam and other main municipalities in The Netherlands. Much more than in the past the clinician should pay attention to information other than birthweight, which can be obtained from the physical examination of the newborn: body proportions and the degree of subcutaneous fat and muscle wasting are important leads to follow.

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Address for reprints:

J.P.R. Doornbos
Department of Obstetrics and Gynaecology
De Heel Hospital
PO Box 210 1500 EE Zaandam
The Netherlands